NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

DRAFT

ENVIRONMENTAL STATEMENT

FOR

TIROS PROGRAM

March 25, 1971

fifth year. The initial TIROS system provided operationally useful data from 1960 to 1965. The TOS system (1966-1970) inaugurated routine daily operational satellite service and met the minimum operational requirements for cloud-cover imagery specified by the using agencies in 1964. The presently approved ITOS series (TIROS-M through ITOS-G) will expand this operational satellite service and is expected to carry NOMSS through 1975.

The ITOS series, of which TIROS-M is the operational prototype, will replace the TOS-series spacecraft currently in operation in the NOMSS. This new series will, for the first time, provide daytime and nighttime cloud-cover observations on a global and regular basis in both direct readout and stored modes of operation. It will provide a major extension of the TOS Program's capabilities and represents a significant advance in the capability of NOMSS, particularly by providing operational infrared data which make it possible to obtain nighttime cloud-cover pictures.

ENVIRONMENTAL IMPACT

The probable total impact of the TIROS program upon the environment comes from its capability to provide cloud-cover imagery and measurements of other meteorological parameters, e.g., the vertical temperature profile, which will further our efforts to understand the physics of the atmosphere, to bring about improved prediction of weather, and to establish a basis for eventual weather modification and climate control rather than from any intrinsic degradation or enhancement of the environment.

Previous spacecraft and launch vehicle hardware and techniques have been studied and analyzed in the light of the Agency's and Nation's extensive experience in space flight. On this basis, the assessment has been made that there has been and will be no significant adverse impact on the environment as a result of the TIROS program.

Atmosphere: The direct adverse impact on the environment by the TIROS missions is almost entirely limited to that caused by the launch vehicle. No evidence has shown any significant lasting impact for frequencies of launch in the foreseeable future. This includes tropospheric, stratospheric and ionospheric pollution or disturbance as well as the return of the spent vehicles either into the sea or burning up during re-entry.

The launch vehicles currently used by NASA for automated science and applications missions range in size from the scout to the Titan IIIC. The propellant combinations used in their stages include solids, LOS/Hydrogen, LOX/RP-1, IRFNA/UDMH, and N_2O_4. A total of approximately

20 of these vehicles are launched annually from four launch sites: Wallops Island, Virginia; Western Test Range, California; Cape Kennedy, Florida; and the San Marco Platform in the Indian Ocean off Kenya.

These small and medium class launch vehicles are considerably smaller than the Saturn class, which is discussed in the Apollo Program Environmental Statement and it is concluded that no detrimental environmental impact results from these launches.

The improved TIROS operational satellites missions will be placed in a polar orbit in from the Western Test Range launch site at Vandenberg Air Force Base, California utilizing the Delta launch vehicle.

There are considered to be no feasible alternatives to the launch of the ITOS spacecraft by these Delta launch vehicles.

The relationship between the local short-term use of the environment of the launch site at the Western Test Range and the maintenance and enhancement of long-term productivity is a close and direct one. A National Academy of Science (NAS) report* estimates that weather forecasts are feasible for one to two weeks in advance using data from satellites of the TIROS program and other NASA and NOAA environmental satellite programs, processed by computers programmed on the basis of improved mathematical models.

The Report, which stressed the extremely high value of weather satellite observations, states "The availability of a 5 to 10 day reliable weath

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*Space Applications Summer Study 1967 Interim Report, Volume 1." NAS-NRC for NASA.

forecast should yield large annual economic benefits from a variety of weather-sensitive activities. A survey of two specific areas -- the construction industry and agriculture -- indicated that realizable savings in these areas alone for the United States should be about $800 million annually. Additional economic benefits will accrue in many other areas such as transportation, flood control, and water-resource allocation, maintenance and repair of public utility systems, and recreational and sporting activities."

This is a typical finding of a number of other such reports which have indicated the relatively high payoff of the weather satellites in relation to other satellite programs.

The weather satellites of the TIROS Program are used extensively for tropical storm surveillance. Since 1966, tropical storms have been detected and tracked by satellite observations, permitting reconnaissance aircraft to concentrate on measurements rather than on search missions. Since the onset of the operational system, meteorologists have found the meteorological satellites' cloud-cover imagery invaluable in detecting and tracking weather systems over about 80 per cent of the earth where conventional observations are not available. This worldwide weather surveillance continues to contribute to more reliable and timely environmental service -- forecasts, advisories, and warnings -- to maritime operations and to communities located within and around the ocean basin. In 1969, 39 hurricanes were identified and tracked by satellite, including 12 Atlantic hurricanes, 10 eastern North Pacific hurricanes, and 17 western North Pacific ocean. The 45 named tropical cyclones that occurred

in the Northern Hemisphere in 1970 were all detected and tracked by satellites. Advisories concerning these storms, and a larger number of unnamed tropical storms in both hemispheres, were sent to U.S. communities and installations and foreign meteorological organizations worldwide.

Satellite data are used by the National Weather Service to improve analyses and prognoses of weather charts prepared for guidance to local weather offices throughout the U.S. For example, forecasts of the onset of precipitation in the western and southwestern U.S. have improved through the routine use of satellite data by forecast offices in that region. Forecasts are now able to follow the development, movement, and changes in the intensity of storms and the associated moisture patterns as they move through the data-sparse areas of the eastern Pacific, Baja California, and Mexico toward the U. S. The benefit obtained from these weather satellite data is more accurate forecasts of rain or no rain for use in activity planning by individuals and commercial, profit-oriented interests.

For the issuance of gale warnings for the North Atlantic, the National Weather Service relies heavily upon satellite surveillance of the region. Satellite observations of that region's cloud cover frequently reveal storm centers which are not indicated by the available convential reports. The resulting benefit is more timely and accurate gale advisory service to maritime interests (commercial and military) which enable these interests to plan ship routes which lead to a shorter passage times and greater productivity.

Other uses for meteorological data from the satellites of the TIROS Program are widespread. The Air Force Global Weather Central receives and uses the global data from operational meteorological satellites on a routine basis in support of the Strategic Air Command and other elements of the Department of Defense. Use of satellite information enabled the Air Force to complete a photo mapping mission one year ahead of schedule. The Naval Oceanographic Office uses TIROS Program data routinely in its sea-ice forecast program for the Arctic and the Antarctic. The satellite photographs were the primary source of data used to support a joint National Science Foundation, U.S. Geological Survey, and U.S. Navy expedition in the South Atlantic. It is Navy practice to use the TIROS Program's satellite data to support "Deep Freeze" -- the Navy's Antarctic re-supply effort -- and to support an Antarctic survey program. Reported benefits which have accrued include (1) a significant decrease in aborted re-supply sorties due to weather betwe Christchurch and the McMurdo Sound area and (2) survey teams accomplished aerial surveys of the continent two years ahead of schedule -- resources devoted to this operation were released to other programs. Along this line, the availability and applicability of satellite data to U.S. Navy stations i Alaska is a factor contributing to a reduction of aircraft ice reconnaissanc patrols by about 50%. Navy meteorologists have relied heavily on cloud-cove data from operational meteorological satellites in supporting the Antarctic re-supply flights between New Zealand and McMurdo. Utility of these data tc this mission contributed to the recommendation to withdraw the Navy ship positioned between New Zealand and Antarctia for the purpose of providing

weather data at a point along the route.

One of the first applications of weather satellites in the area of oceanography was in the mapping of sea-ice boundaries. While the resolution of current satellite instrumentation precludes obtaining information concerning the age and condition of ice, it is possible to determine the extent of the ice and obtain an indication of the stage of formation and breakup. Such information is of obvious value to maritime interests and is currently being used operationally by ice forecasting centers in North America.

FUTURE PRODUCTIVITY PAYOFFS

The NAS Report estimates that data from satellites processed by computers programmed on the basis of improved mathematical models will, within the foreseeable future, make it possible to have accurate weather forecasts -- as accurate as present 2-day forecasts, covering 5-10 day periods in advance. On this premise, it is not difficult to imagine significant payoffs of accurate 10-day forecasts to agriculture, construction, lumbering, aviation, and the maritime services.

There are no irreversible and irretrievable commitments of natural resources which are, or will be, involved in the continuation of the ongoing TIROS Program.